Fig. 1

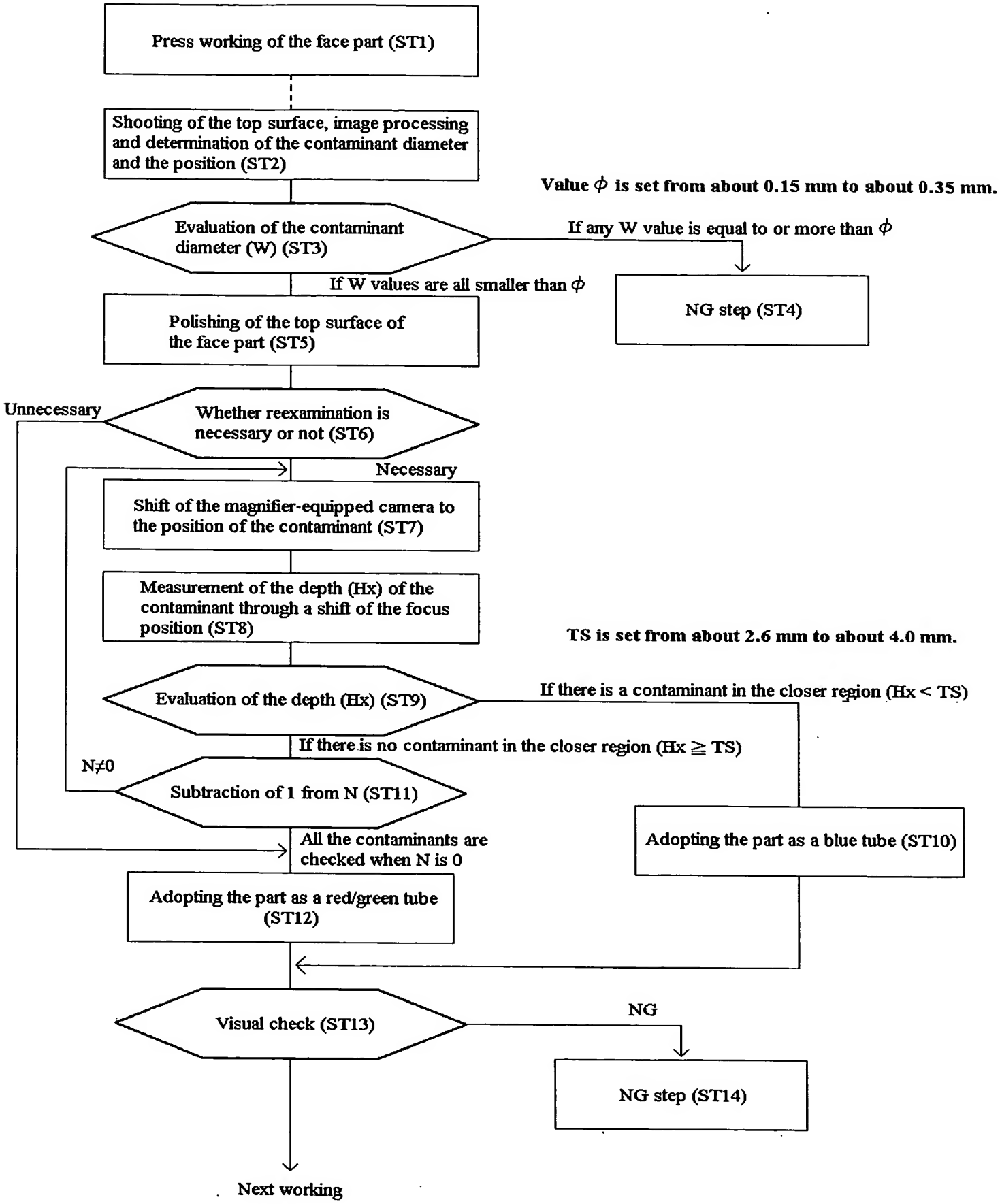

Press working of the face part (ST1)
Shooting of the top surface, image processing and determination of the contaminant diameter and the position (ST2)
Value ϕ is set from about 0.15 mm to about 0.35 mm.
Evaluation of the contaminant diameter (W) (ST3)
If any W value is equal to or more than ϕ
If W values are all smaller than ϕ
NG step (ST4)
Polishing of the top surface of the face part (ST5)
Unnecessary
Whether reexamination is necessary or not (ST6)
Necessary
Shift of the magnifier-equipped camera to the position of the contaminant (ST7)
Measurement of the depth (Hx) of the contaminant through a shift of the focus position (ST8)
TS is set from about 2.6 mm to about 4.0 mm.
Evaluation of the depth (Hx) (ST9)
If there is a contaminant in the closer region (Hx < TS)
If there is no contaminant in the closer region (Hx ≧ TS)
N≠0
Subtraction of 1 from N (ST11)
Adopting the part as a blue tube (ST10)
All the contaminants are checked when N is 0
Adopting the part as a red/green tube (ST12)
Visual check (ST13)
NG
NG step (ST14)
Next working

Fig. 2

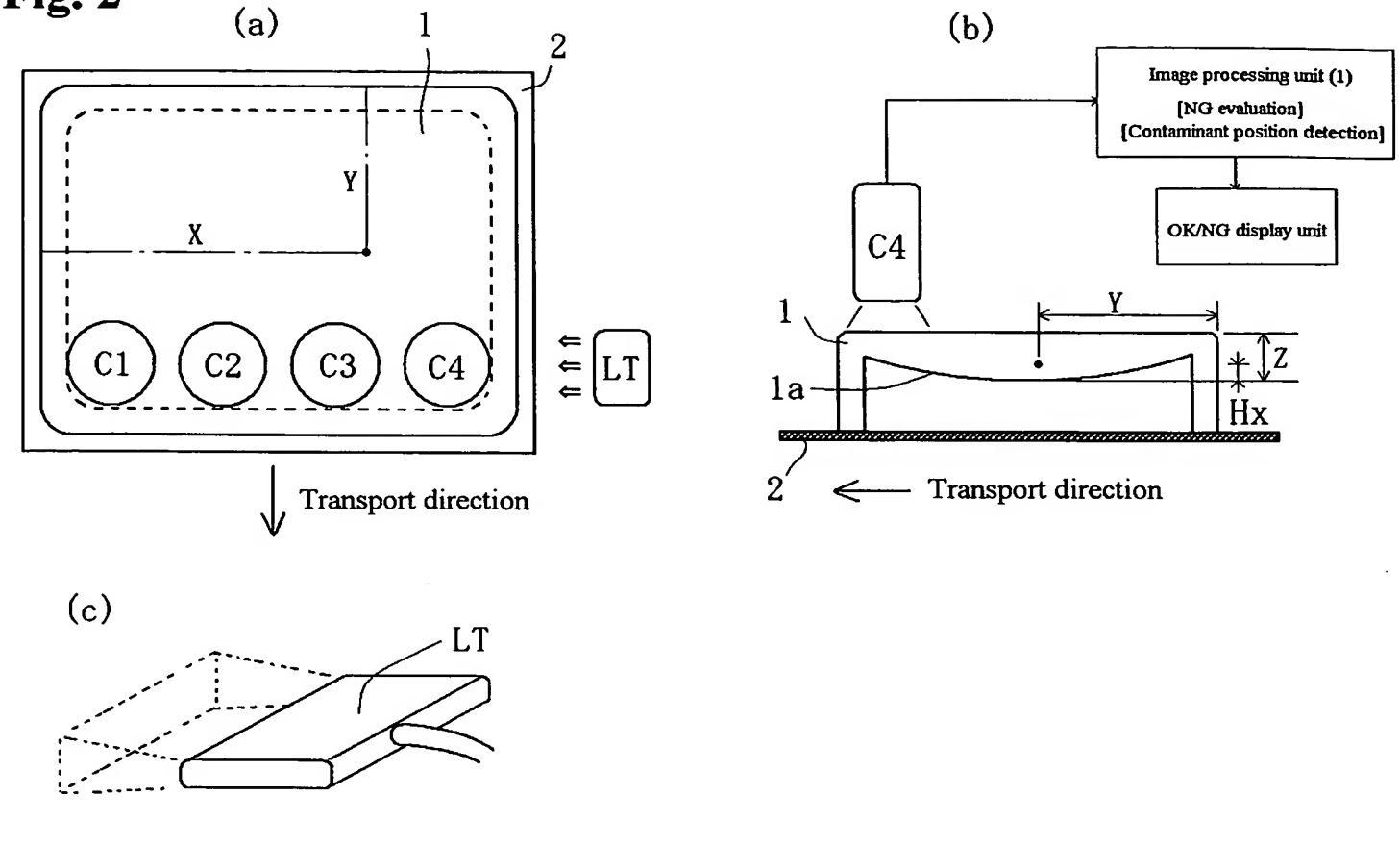

(a)
1
2
Y
X
C1
C2
C3
C4
LT
Transport direction
(b)
Image processing unit (1)
[NG evaluation]
[Contaminant position detection]
OK/NG display unit
C4
1
Y
Z
1a
Hx
2
Transport direction
(c)
LT

Fig. 3

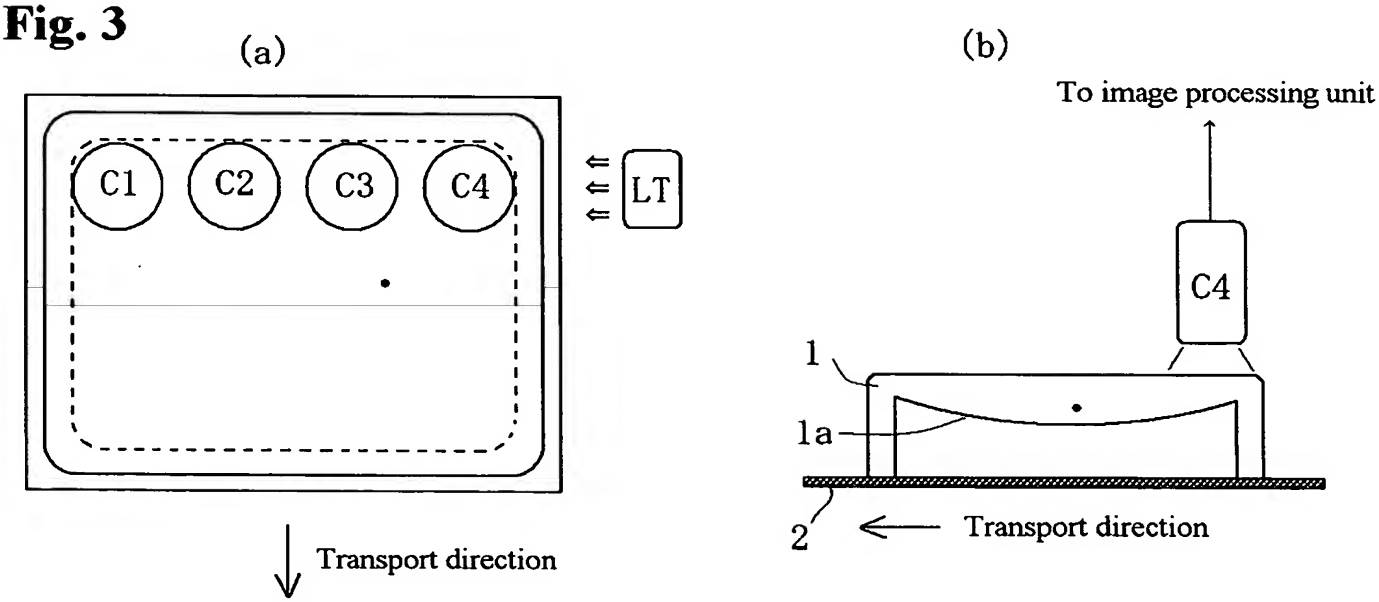

(a)
C1
C2
C3
C4
LT
Transport direction
(b)
To image processing unit
C4
1
1a
2
Transport direction

Fig. 4

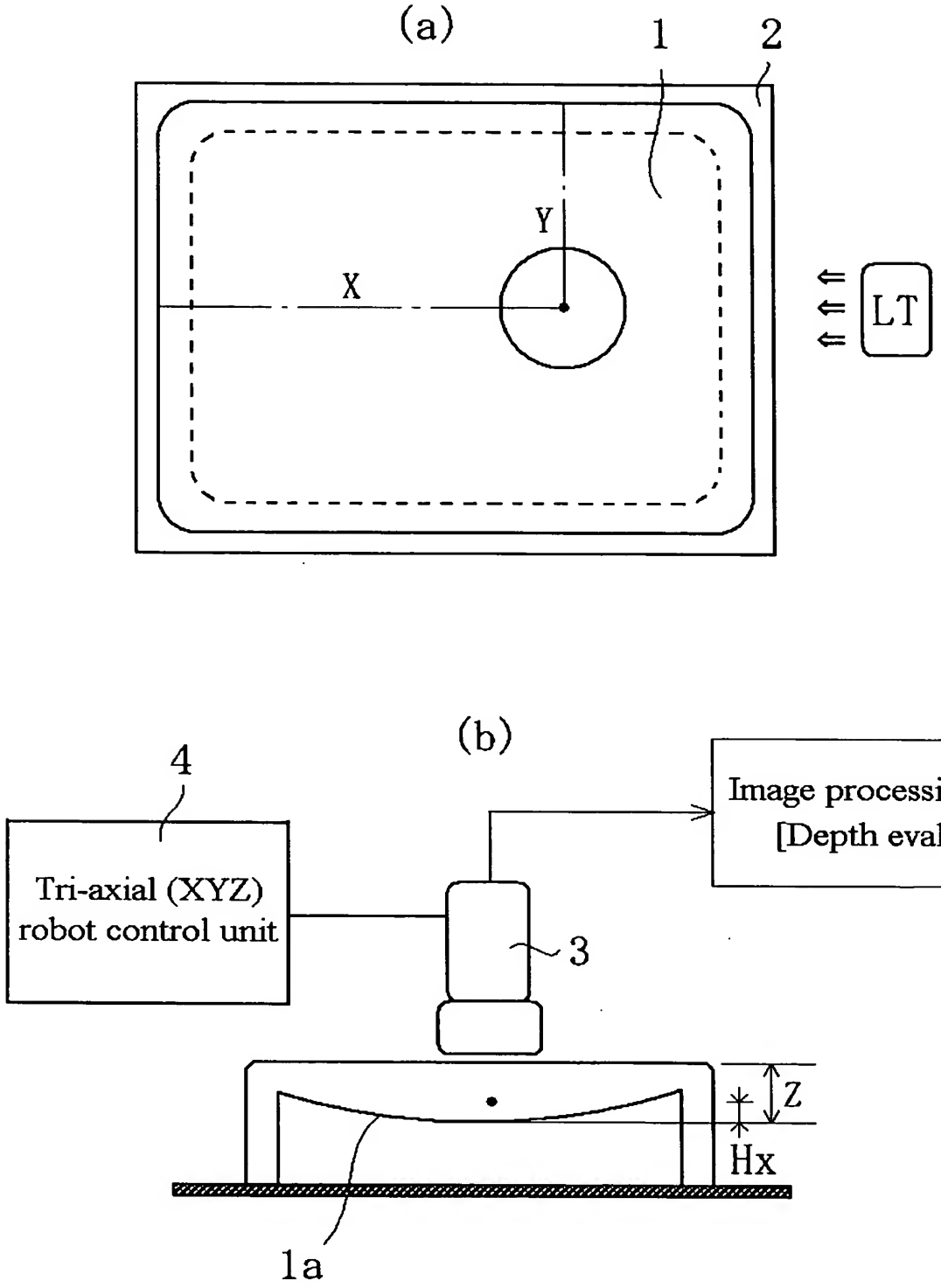
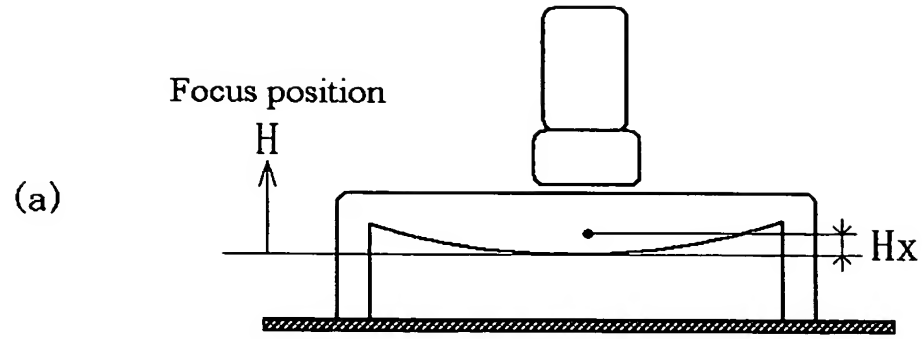
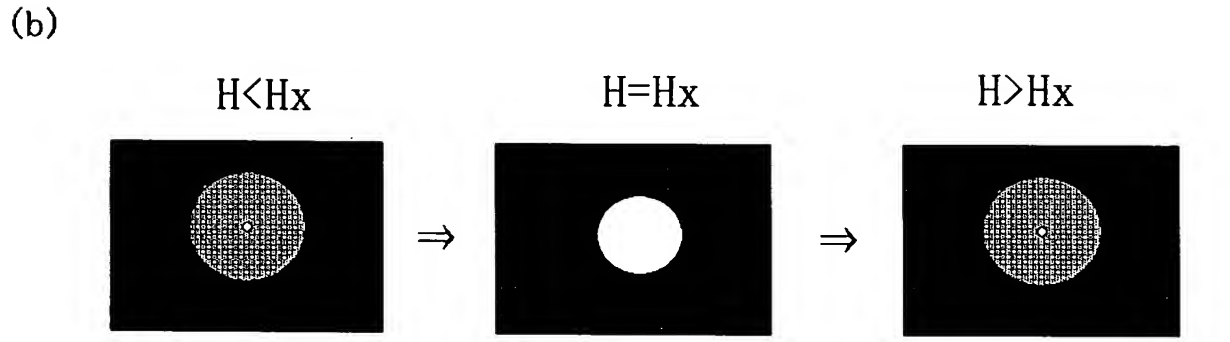
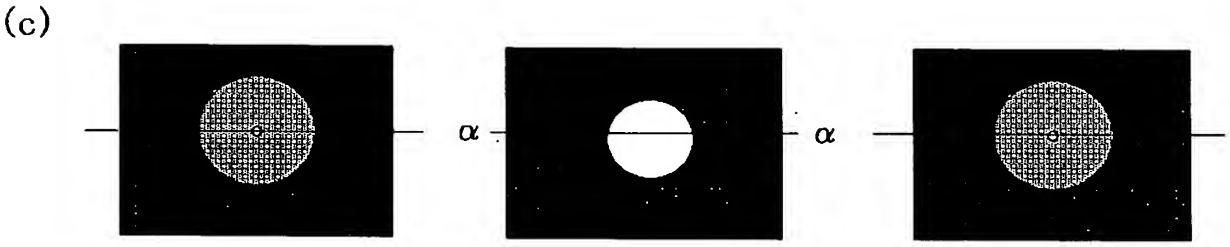

(a)
1
2
Y
X
LT
(b)
4
Image processing unit (2)
[Depth evaluation]
Tri-axial (XYZ)
robot control unit
3
Z
Hx
1a

Fig. 5


(a)
Focus position
H
Hx


(b)
H<Hx
H=Hx
H>Hx


(c)
α
α

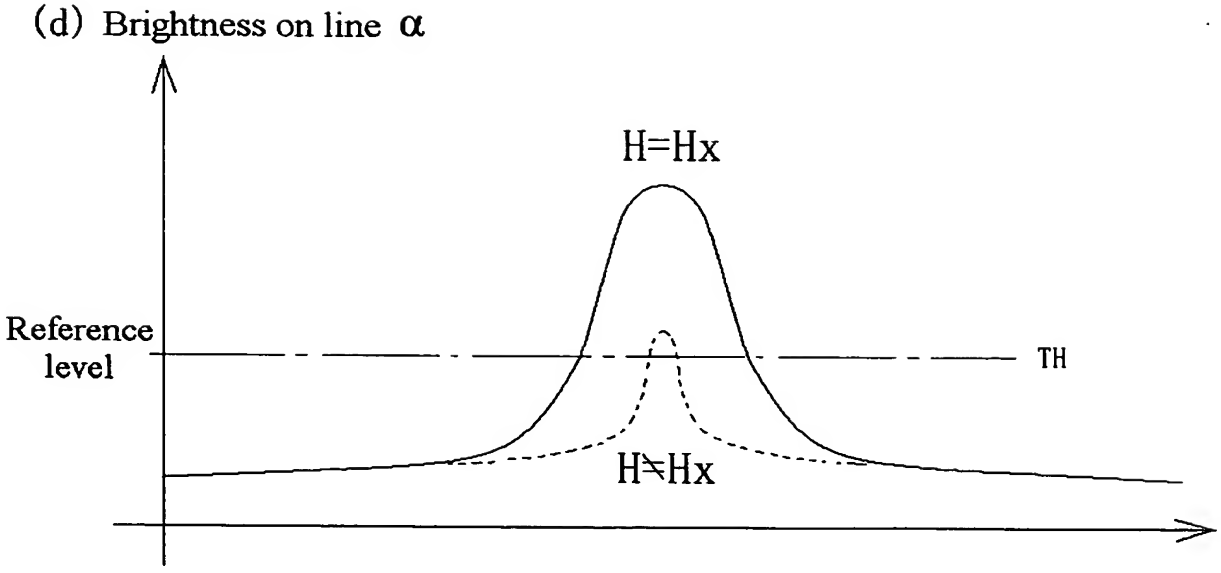

(d) Brightness on line α
H=Hx
Reference level
TH
H≒Hx

Fig. 6

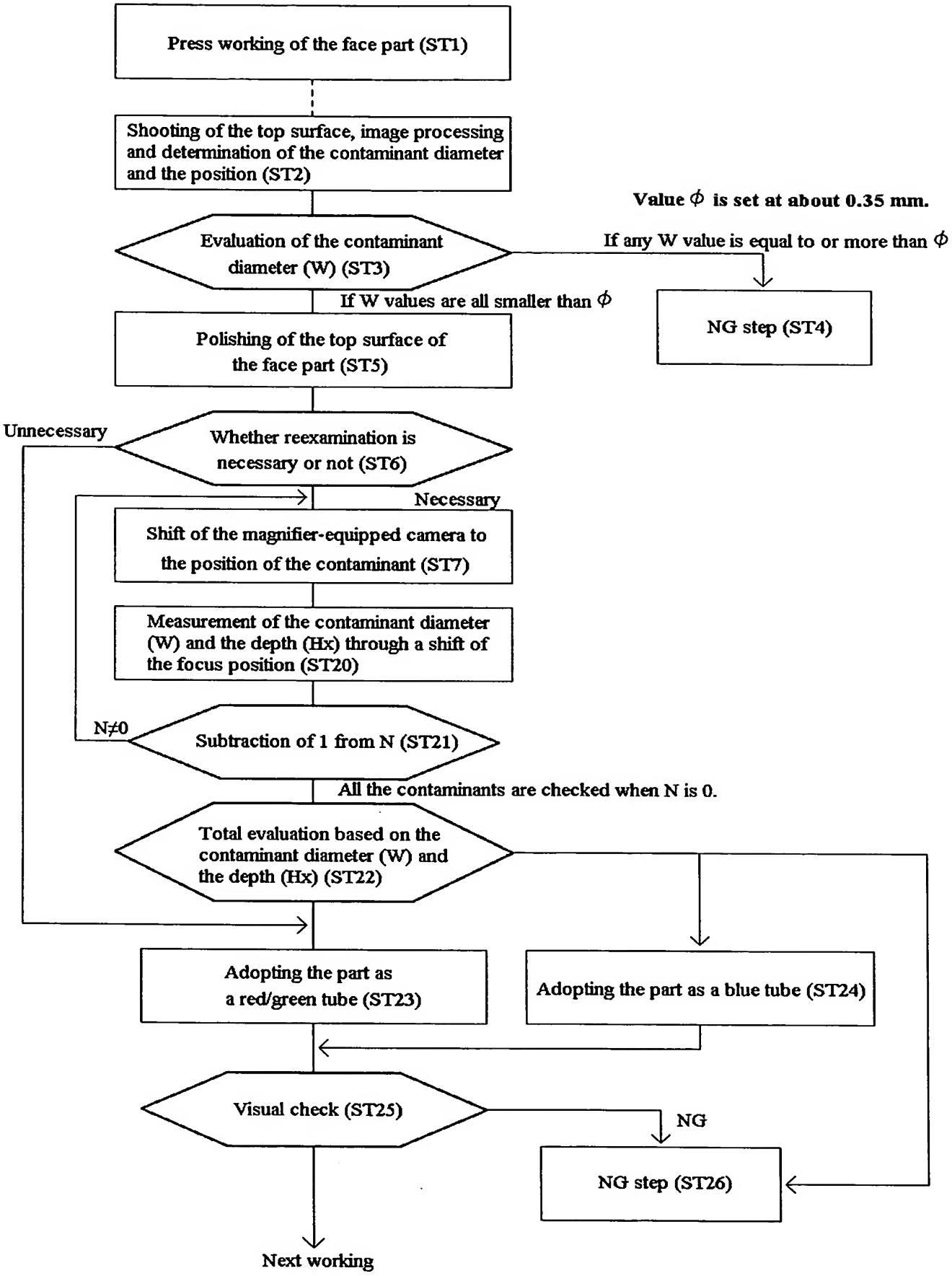

Press working of the face part (ST1)
Shooting of the top surface, image processing and determination of the contaminant diameter and the position (ST2)
Value ϕ is set at about 0.35 mm.
Evaluation of the contaminant diameter (W) (ST3)
If any W value is equal to or more than ϕ
NG step (ST4)
If W values are all smaller than ϕ
Polishing of the top surface of the face part (ST5)
Unnecessary
Whether reexamination is necessary or not (ST6)
Necessary
Shift of the magnifier-equipped camera to the position of the contaminant (ST7)
Measurement of the contaminant diameter (W) and the depth (Hx) through a shift of the focus position (ST20)
N≠0
Subtraction of 1 from N (ST21)
All the contaminants are checked when N is 0.
Total evaluation based on the contaminant diameter (W) and the depth (Hx) (ST22)
Adopting the part as a red/green tube (ST23)
Adopting the part as a blue tube (ST24)
Visual check (ST25)
NG
NG step (ST26)
Next working

Fig. 7

Evaluation criteria for red or green tube

TBL1 T S＝2.6～4.0mm

Depth H	T S≦H Contaminant more distant from fluorescent film surface	T S＞H Contaminant closer to fluorescent film surface
Contaminant diameter W	Less than φ 1	Less than φ 2

φ 1＝0.15～0.3mm

φ 2＝0.10～0.15mm

Evaluation criteria for blue tube

TBL2 T S＝2.6～4.0mm

Depth H	T S≦H Contaminant more distant from fluorescent film surface	T S＞H Contaminant closer to fluorescent film surface
Contaminant diameter W	Less than φ 3	Less than φ4

φ 3＝0.25～0.35mm

φ 4＝0.2～0.3mm

Fig. 8

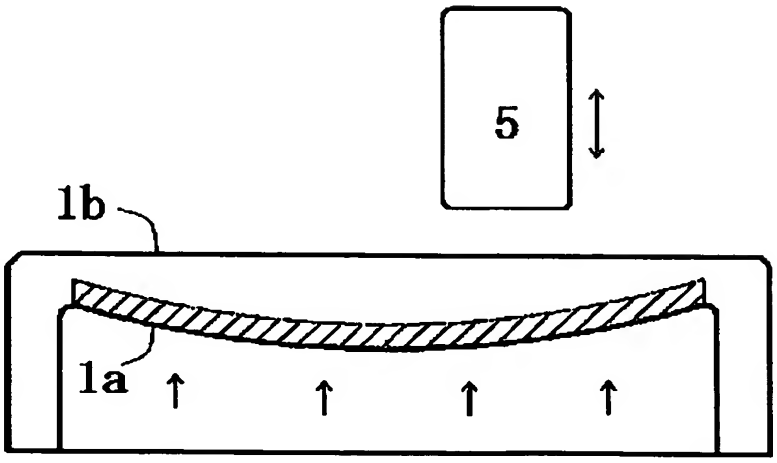
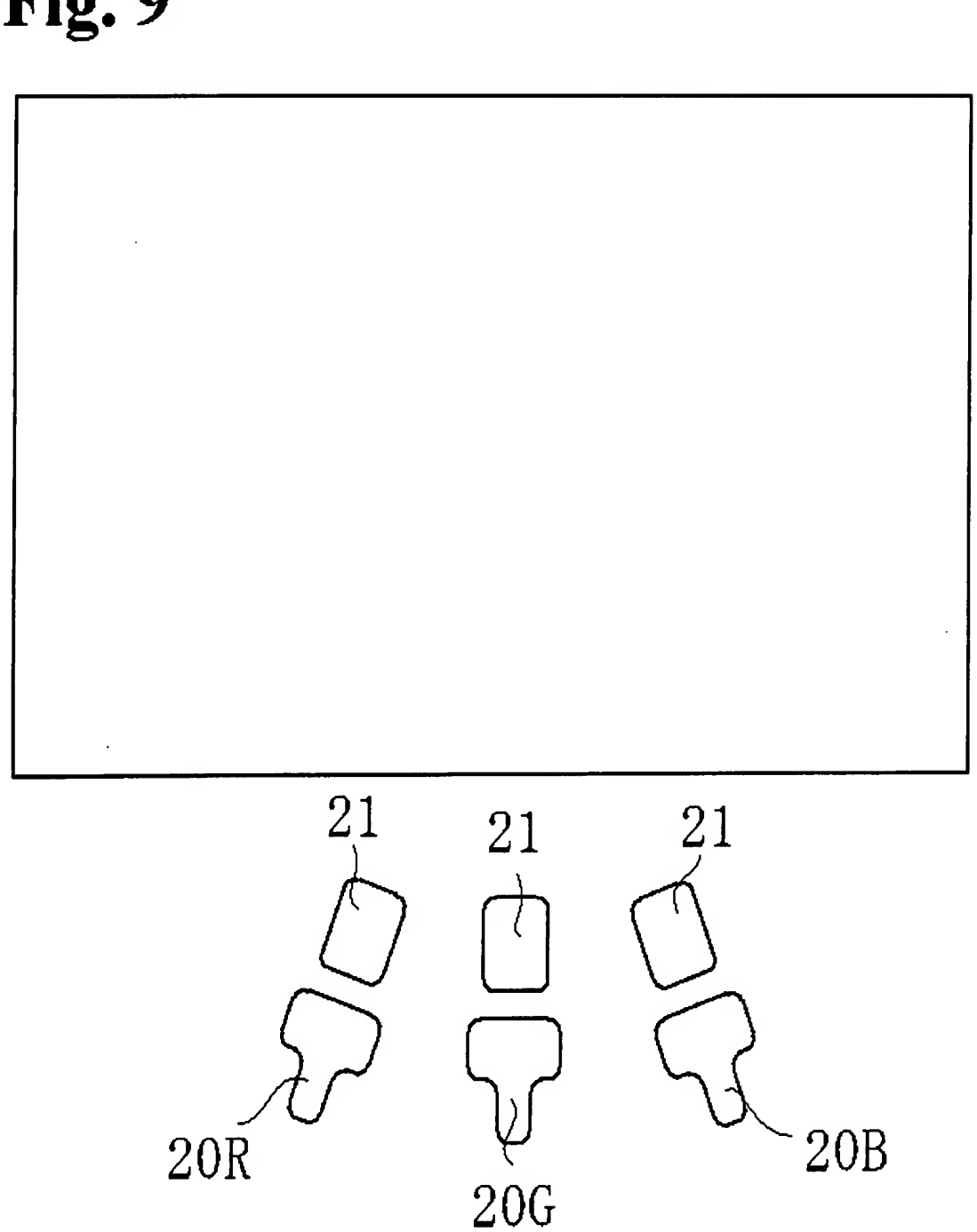


Fig. 9



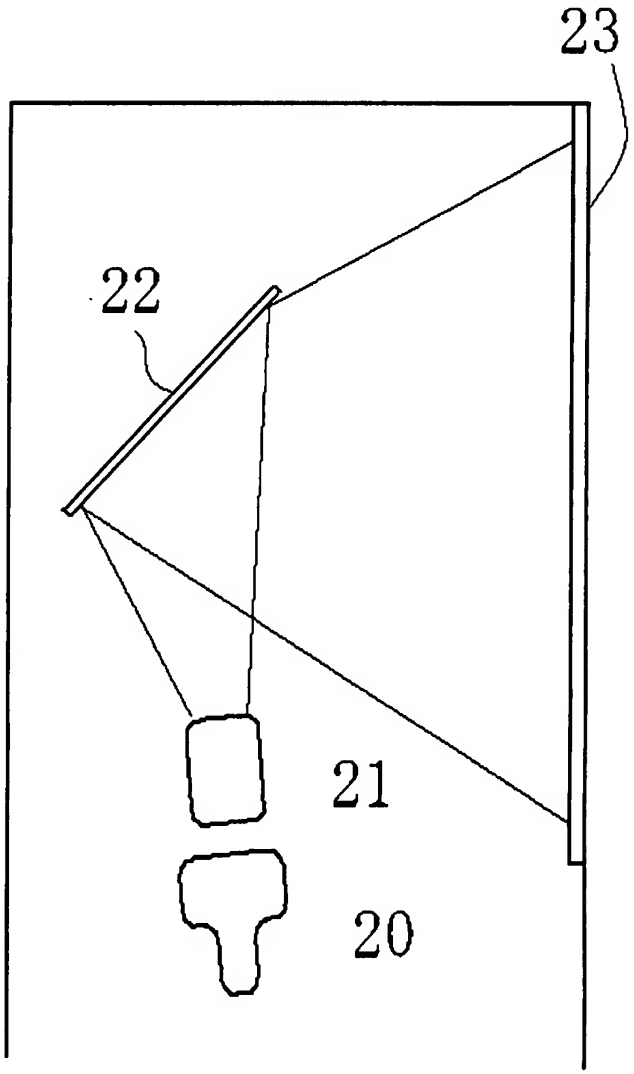


Fig. 10